24 September 1969

U. S. ARMY TEST AND EVALUATION COMMAND
COMMON SERVICE TEST PROCEDURE

FUEL AND OIL CONSUMPTION

1. OBJECTIVE

The objective of this Materiel Test Procedure is to determine the fuel and oil consumption, cruising range, and battlefield day capability of the test item and the capability of the test item to accept fuel from standard or available developmental refueling equipment.

2. BACKGROUND

Fuel and oil are the life blood of mechanized combat operations. The rate at which this life blood is consumed determines the length of time that mechanized vehicles are useful on the battlefield. The sustained operation of vehicles is dependent on many factors - of which the most important is the ready availability of the fuel and oil. Next in importance is the time it takes to refuel. In order to have sufficient fuel available, it is necessary for the logistical planners to know how much fuel and oil will be required for the number of vehicles in the operation, and to have this commodity readily available in fast dispensing refueling equipment. The importance of fuel and oil to sustained operations is vividly portrayed in the combat action reports of the Third U. S. Army in Europe during World War II. The lack of ready availability of fuel and oil for the vehicles of this powerful mechanized Army slowed the advance of the offensive sufficiently to allow the enemy forces to regroup and delay for some time the final outcome of this gigantic struggle. For the logisticians to know these requirements it is vital that each vehicle's consumption of fuel and oil under various operating conditions be precisely determined and recorded.

3. REQUIRED EQUIPMENT

a. Suitable Test Courses:

1) Paved roads
2) Secondary and gravel roads
3) Cross-country terrain

b. Standard or Development Vehicle Mounted Bulk Fuel Dispensers with calibrated flow meter.

c. Stop Watches, preferably with luminous dials.

d. Drivers and alternate drivers, and crews as required.

e. Forms for recording data.

4. REFERENCES

A. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.

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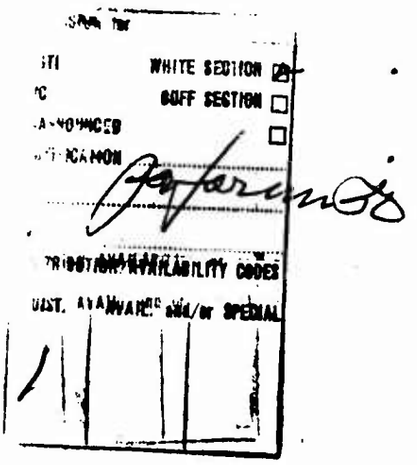

B. MTP 2-3-504, Cross-Country Mobility.
C. MTP 2-3-505, Road Mobility.
D. MTP 2-3-506, Simulated Tactical Operations.
E. MTP 2-3-509, Fording.
F. MTP 2-3-510, Inland Waterway Operations.

5. SCOPE

5.1 SUMMARY

This MTP describes the following procedures for determining the fuel and oil consumption of military vehicles under a variety of conditions stipulated in the test item's Qualitative Materiel Requirement (QMR) or other applicable document:

a. Preparation for Test - Procedures for preparing the vehicle and test course and for familiarizing test personnel.

b. Cruising Range Test (All Vehicles) - An evaluation to determine in miles, the cruising range and rate of fuel comsumption of the test vehicle(s) while traversing prescribed courses.

c. Cross-country, Secondary Road and Highway Driving (All Vehicles) - An evaluation to determine the amount of fuel and oil consumed by the test vehicle(s) in order to compute the fuel comsumption in gallons per mile and gallons per hour.

d. Battlefield Day (Tanks and Tracked Vehicles Which Accompany Tanks only) - An evaluation to determine the length of time (in hours) that the vehicle can operate continuously on a full tank of fuel over indicated simulated battlefield terrain.

e. Overall Fuel and Oil Consumption - An evaluation to determine the test vehicle(s) test mileage and fuel and oil consumption during testing.

f. Refueling - An evaluation to determine the time it takes to refuel a test vehicle during cruising range testing with standard bulk dispensers and available developmental dispensers.

5.2 LIMITATIONS

The fuel tanks will normally be filled from empty to full with the test vehicle positioned on level ground only.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Safety

The test officer shall ensure that a safety release, which includes information pertaining to operational limitations and specific hazards peculiar to the test item, has been received from HQ USATECOM.

6.1.2 Vehicle Preparation

The project officer will ensure that the test item is in full operating condition with combat loads if applicable. The QMR, SDR, or other applicable documents will be checked to ensure that the vehicle has its rated payload, with or without towed load. The following will be recorded for each test vehicle:

a. Nomenclature.
b. Model.
c. Serial number.
d. Fuel type to include alternates if applicable.
e. Stowed weight and/or rated payload of test vehicle and towed load when applicable.

6.1.3 Course Preparation

Reconnoiter and prepare an overlay of the driving courses for the various tests to be accomplished. Ensure that the courses are adequate in distance and available at the time of the scheduled test.

6.1.4 Personnel

The project officer will ensure the availability of service personnel who have been briefed on the objectives of the test and are cognizant of the operation, maintenance, and refueling procedures of the test item and have been advised of the test items safety hazards and operation limitations.

6.2 TEST CONDUCT

6.2.1 Cruising Range Test (All Vehicles)

Determine the test vehicles cruising range and rate of fuel consumption as follows:

a. Drive the test vehicle early in its service test period, without towed load and with a full fuel tank, at prescribed convoy speeds, with halts of 15 minutes duration every 2 hours with the engine off, until it runs out of fuel, over the following terrain for the percentages specified:

NOTE: Cooling down procedures will be observed when applicable.

1) Thirty percent of the cruising range over paved roads.
2) Forty percent over unpaved roads.
3) Thirty percent over cross-country.

NOTE: If there have been sufficient operations to determine the fuel consumption for each type vehicle, then this figure can be used to determine the number of miles to run in each category. However, one must intentionally undershoot the capacity of the vehicle to ensure that the cycle is completed before the vehicle runs out of fuel.

b. Record the following at the start of the cruising range run:

1) Vehicle serial number
2) Vehicle gross weight
3) Identity of vehicle driver
4) Odometer reading

c. Record the following during the cruising range run:

1) Description and condition of the various parts of the course
2) Appropriate weather conditions
3) Date of operation
4) Convoy speed over the various parts of the course

d. Refuel the test vehicle when it runs out of fuel, using the procedures described in paragraph 6.2.5, and record the following:

1) Odometer reading of the test vehicle
2) Total miles test vehicle was operated
3) Total hours test vehicle engine was operated
4) For refueling procedures:

a) Attitude of vehicle (i.e. level ground, slope)
b) Amount of fuel required to replenish fuel tanks
c) Time required to replenish fuel
d) Type of refueling equipment used
e) Difficulties encountered during refueling, if any
f) Maximum refueling dispensing rate

5) Amount of oil required

e. Repeat the procedures of steps a through d, using different drivers and the various types of fuel dispersing equipment available.

f. Repeat the procedures of steps a through e with towed load and record the gross weight of the load.

g. Repeat the procedures of steps a through f for all alternate fuels if applicable.

h. Repeat the procedures of steps a through g near the end of the test item's service test period.

6.2.2 Cross-Country, Secondary Road and Highway Driving (All Vehicles)

Determine the test vehicles fuel and oil consumption, under various specified conditions as follows:

a. Operate the test vehicle, starting with full fuel tanks, without towed load, for four continuous hours over each of the following terrain conditions:

NOTE: Different drivers shall be used each time the tests are repeated.

1) Cross-country dry, at speeds not to exceed 10 mph
2) Cross-country muddy, at speeds not to exceed 10 mph
3) Gravel roads at normal convoy operating speeds
4) Hard surface highways at normal convoy operating speeds

b. Record the following at the start of each test run:

1) Vehicle serial number
2) Venicle gross weight
3) Identity of vehicle driver
4) Odometer reading

c. Record the following during each run:

1) Description and condition of test course
2) Appropriate weather conditions
3) Date of operation
4) Vehicle speed

d. At the completion of each four hour run replenish the fuel tanks and record the following:

1) Amount of fuel required to fill tanks
2) Time required to fill tanks
3) Odometer reading
4) Quarts of oil required
5) Total time vehicle engine was operated

e. Repeat the procedures of steps a through d with a towed load and record the gross weight of the trailer.

6.2.3 Battlefield Day (Tanks and Tracked Vehicles Which Accompany Tanks Only)

Determine the length of time the test vehicle can operate continuously on a full tank of fuel as follows:

NOTE: If any maintenance is required to be performed to prevent damage this should be recorded.

a. Select a course where the vehicle with a full tank of fuel can operate as follows unless otherwise prescribed by QMR's or SDR's:

1) Twenty-four minutes cross-country at 2½ - 10 mph followed by;
2) Twelve minutes on dirt or gravel on secondary roads followed by:
3) Twenty-four minutes idle period at rpm specified by the technical manual or by the manufacturer.

b. Continue the sequence of step a until the engine stops from lack of fuel.

NOTE: When refueling the test vehicle use the procedures described in paragraph 6.2.5.

c. Record the following for the test run:

1) Data collected as described in steps b through d of paragraph 6.2.1
2) Total amount of oil used
3) Idling speed of engine

d. Repeat the procedures of steps a through c a minimum of four times under the following circumstances:

NOTE: These procedures are to be evenly spaced throughout the service test.

1) Twice under dry terrain conditions, using different drivers
2) Twice under muddy terrain conditions, using different drivers

6.2.4 Overall Fuel and Oil Consumption

Determine the overall fuel consumption of the test vehicle as follows:

a. Obtain the fuel and oil consumption data accumulated during the following procedures:

1) Cross-Country Mobility (MTP 2-3-504)
2) Road Mobility (MTP 2-3-505)
3) Simulated Tactical Operations (MTP 2-3-506)
4) Fording (MTP 2-3-509)
5) Inland Waterway Operations (MTP 2-3-510)

b. Combine the data of step a with the pertinent data obtained during the conduct of procedures of paragraphs 6.2.1, 6.2.2, and 6.2.3.

c. Record the total amount of fuel and oil actually consumed during the entire service test and the amount of oil required for oil changes.

6.2.5 Refueling

Refuel test vehicles using the following procedure.

a. Normally fuel tanks will be filled from empty to full with test vehicle positioned on level ground. However, if a visual inspection of the fuel tank and filler tube assembly reveals any feature that might drastically reduce the refueling rate or prevent refueling when the vehicle is not on level ground it will be positioned on a side slope in the most adverse attitude and refueling attempted.

b. Refueling will be done at the maximum rate acceptable by the fuel tank and its filler tube.

NOTE: Data required for fueling is listed in paragraph 6.2.1.d.

6.3 TEST DATA

6.3.1 Preparation for Test

Record the following for each test vehicle:

a. Nomenclature.
b. Model.
c. Serial number.
d. Type fuel used, if multifuel engine list all types.
e. Stowed weight and/or rated payload of test vehicle and towed load, when applicable.

6.3.2 Test Conduct

6.3.2.1 Cruising Range Test (All Vehicles)

NOTE: See Appendix A for a sample data sheet.

Record the following:

a. For each vehicle under test:

1) Vehicle serial number
2) Vehicle gross weight in pounds

b. For each vehicle run:

1) Type run (towing, no towing)
2) Trailer load in pounds, if applicable
3) Run number
4) Identity of vehicle driver
5) Odometer reading:

a) At start of run
b) At end of run

6) Description and condition of each portion of the course
7) Appropriate weather conditions (rain, snow, clear, etc.)
8) Date of operation in day, month, year
9) Convoy speed in miles:

a) Over paved roads
b) Over unpaved roads
c) Over cross-country

10) Total miles vehicle was operated
11) Total time vehicle engine was operated in hours

c. For refueling operations:

1) Attitude of vehicle
2) Amount of fuel required in gallons and tenths

3) Time required to replenish fuel
4) Type of fuel used
5) Type of refueling equipment used
6) Maximum refueling dispensing rate
7) Difficulties encountered during refueling, if any

d. Amount of oil required in quarts.

6.3.2.2 Cross-Country, Secondary Road and Highway Driving (All Vehicles)

NOTE: See Appendix B for a sample data sheet.

Record the following:

a. For each vehicle under test:

1) Vehicle serial number
2) Vehicle gross weight in pounds

b. For each vehicle 4-hour run:

1) Type run (towing, no towing)
2) Trailer load in pounds if applicable
3) Test Course (Cross-country dry, gravel road, etc)
4) Run number
5) Identity of vehicle driver
6) Odometer reading:

a) At start of run
b) At end of run

7) Appropriate weather conditions (rain, snow, etc)
8) Date of operation in day, month, year
9) Vehicle speed in mph
10) Amount of fuel required to fill tank in gallons and tenths
11) Time required to fill tank in minutes
12) Amount of oil required in quarts
13) Total time vehicle engine was operated in hours

6.3.2.3 Battlefield Day (Tanks and Tracked Vehicles Which Accompany Tanks Only)

NOTE: See Appendix C for sample data sheet.

Record the following:

a. Data collected as described in steps b through d of paragraph 6.2.1.
b. Total amount of oil used.
c. Engine idling speed in rpm.
d. Maintenance performed as required.

6.3.2.4 Overall Fuel and Oil Consumption

Record the following for the entire service test:

a. Total mileage vehicle was operated
b. Total hours the engine was operating
c. Total fuel consumed in gallons and tenths
d. Total oil consumed in quarts
e. Total oil required for changes in quarts

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Cruising Range (All Vehicles)

Using the data of paragraph 6.3.2.1 calculate the following (see Appendix A for sample), with and without a towed load; for the various vehicles and terrain conditions:

a. Miles per gallon of fuel for wheeled vehicles
b. Gallons of fuel per mile for heavy track vehicles
c. Miles per quart of oil used
d. Refueling time

6.4.2 Cross-Country, Secondary Roads and Highway Driving (All Vehicles)

Using the data of paragraph 6.3.2.2 calculate the following (see Appendix B for sample), with and without a towed load, for the various drivers and terrain conditions:

a. Average amount of gallons used
b. Time required to refuel
c. Quarts of oil used and average quarts of oil per mile
d. Miles per gallon of fuel for wheeled vehicles
e. Gallons of fuel per mile for heavy track vehicles

6.4.3 Battlefield Day (Tank and Tracked Vehicles Which Accompany Tanks Only)

Using the data of paragraph 6.3.2.3 calculate the following (See Appendix C for sample):

a. Quarts of oil used per gallon of fuel.
b. Hours of engine operation per gallon of oil.

6.4.4 Overall Fuel and Oil Consumption

Using the data obtained during the conduct of paragraphs 6.2.1 through 6.2.3 and in the specified tests of paragraph 6.2.4 calculate the following for each test vehicle (See Appendix D for sample):

a. Oil consumption in miles per quart
b. Gallons of fuel per gallon of oil
c. Engine operating hours per quart of oil
d. Total amount of oil consumed including oil changes

e. For fuel comsumption as appropriate:

1) Gallons of fuel per mile of operation
2) Gallons of fuel per hour of operation
3) Miles of operation per gallon of fuel

APPENDIX A
SAMPLE FORM FOR DATA RECORDING

FUEL CONSUMPTION DATA - CRUISING RANGE (ALL VEHICLES)

Date_____

Without Towed Load

Vehicle Identity	Test Run No.	Cruising Range Miles	Refill Usable Capacity	Refuel Time	Miles* per Gallon	Gal** per Mile	Miles per Quart	Hours Engine Operate	Course Condition
With Towed Load									

*Miles per gallon for wheeled vehicles

**Gallons per miles for heavy track vehicles

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APPENDIX B
SAMPLE OF DATA RECORDING SHEET

FUEL CONSUMPTION, CROSS-COUNTRY, SECONDARY ROADS & HIGHWAYS
(ALL VEHICLES)

Date_____

Four Hour Test Period

Without Towed Load

Vehicle Number	Driver's Name	Run No.	Course Condition	Gallons to Refill	Time to Refill	Quarts of Oil	Engine Operating Hr	Miles* per Gallon	Gal** per Mile
With Towed Load									

*Miles per gallon for wheeled vehicles

**Gallons per mile for heavy track vehicles

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APPENDIX C
SAMPLE OF DATA RECORDING SHEET

BATTLEFIELD DAY (TANKS AND TRACKED COMBAT VEHICLES)

Date_____

Vehicle Number	Driver's Name	Dry Weather Run Number	Wet Weather Run Number	Hr to Eng Stop	Miles to Eng Stop	Quarts Oil	Gallons Fuel	Quarts/ Gallon	Engine Hours	Engine Hr/ Quart Oil

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APPENDIX D
SAMPLE FORM FOR SUMMARY OF PERTINENT DATA

a. Fuel

Vehicle	Gallons	Miles	Engine Hours	Miles/Gallon	Refueling Rate	
					Rqr*	Actual

*As specified by QMR or other applicable document

b. Oil (excluding oil changes)

Vehicle	Miles	Quarts Added	Miles/ Quart	Engine Hours	Engine [illegible] / Gallon Oil	Gal Fuel/ Gal Oil

c. Total Oil (including oil changes)

Vehicle	Miles	Quarts Added	Oil Changes	Miles Quart	Eng Hr/ Operation	Eng Hr/ Gal Oil	Gal Fuel/ Gal Oil